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The use of the internet in document delivery – a NORDINFO project

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1. Introduction

Inter-Scandinavian co-operation plays an important role in university and research libraries in the Nordic countries, Denmark, Finland, Iceland, Norway and Sweden. Especially interlibrary loan requests and document delivery are significant parts in the Nordic library co-operation. The Nordic Council for Scientific Information, NORDINFO, has contributed in several projects to improvements in document ordering and delivery. NORDINFO has for many years been involved in NOSP, the Nordic union catalogue of serials, where serials in about 600 Nordic libraries can be located. In the IANI project, the Intelligent Access to Nordic Information Services, an online ordering module was also originally scheduled[1].

The Information Service of the Technical Research Centre of Finland (VTT) has carried out several projects for NORDINFO in different fields of library and information service. Some recent projects have concerned new possibilities in document delivery. A desk study on the use of satellites in document delivery was completed in 1992. In addition to some technical problems, the costs associated with satellite technology appeared to be still too high for document delivery. The VTT Information Service has recently managed, in co-operation with the British Library Document Supply Centre and the Chalmers University of Technology Library in Sweden, a Group 4 facsimile project for transmission of documents. Group 4 fax was found to be a good method for fast and reliable transmission of documents of high quality. However, high equipment costs, some incompatibility between different suppliers' equipment, the need for 64 kb/s digital networks and also the widely used Group 3 fax will probably delay a more general use of Group 4 fax. In the most recent NORDINFO document delivery project, the VTT Information Service has managed an investigation of the use of the Internet, e.g., academic networks based on TCP/IP protocol, for document transmission between Nordic university libraries. A software called Ariel, developed by the Research Libraries Group in the US, was used in the project. Seventeen university libraries in the five Nordic countries participated in the project, which started in September 1992 and finished in

June 1993. The transmission of documents over the Internet continues in most of the libraries.

2. The goals of the NORDINFO project

The primary aim of the NORDINFO project was to find new solutions for improving the speed and the quality of document transmission in the Nordic countries. The project intended to test the suitability of the new American software for Nordic and European conditions and standards. Another important task was to study how suitable Ariel was for use in Nordic interlending routines. The possibilities of integrating Ariel in normal library work were other significant questions. Problems during installation and use, as well as strong and weak points in Ariel, were registered during the project. Suggestions for improvements in the software were collected for presentation to the developer of the software. Especially the Nordic and European point of view was considered important. The basic idea was to use Ariel as a part of each library's regular interlending work according to the capabilities of the library.

3. The functions of Ariel

Ariel is developed by the Research Libraries Group, RLG in the United States. The system is comprised of the Ariel software and standard equipment consisting of a microcomputer, a scanner, a laser printer and an Internet connection. The documents are scanned, compressed and transmitted over the Internet for printing. The Ariel software is designed to work on PCs connected to an Ethernet local area network, which in turn has a direct high-speed connection to the Internet. The technical requirements are presented below. Ariel can presently be used with the following scanners and printers:

- basic PC: 386 (min. 8 MHz 286), 80 MB hard disk (min. 30 MB)
- Ether ink: 3Com etherlink II card or other
- scanner: HP ScanJet IIp or IIc
- printer: HP LaserJet II, II or IV or equivalent
- paper size: legal 11" and 14"
- transfer protocol: TFTP (Trivial File Transmission Protocol)
- transport protocol: UDP (User Datagram Protocol).

A 386 computer is recommended for high-volume suppliers, but a slower 286 machine is acceptable for small volume operations. A printer accelerator card is optional, but is

needed when receiving large amounts of documents. Ariel can currently transfer data only to another application with the same Ariel software.

Pages of the document are directly scanned as bit-mapped images and compressed. With the present version of the software the scanned pages cannot be examined on the screen, but can be printed locally. The files are temporarily stored in the PC and transmitted to the receiving PC for decompression and printing. Transmission error detection is included in the software. The system provides for up to 28 attempts to make a succesful transmission. Some of the specific features of using Ariel are simultaneous scan, send and receive, high speed transmission, high quality of transmitted documents, the currently free use of the Internet, and non-dedicated apparatus.

4. Realisation of the project

The production version of the Ariel software was released in September 1991. The VTT Information Service acquired the software the same year. According to the first experiences at the VTT Information Service, the software was technically working, but was obviously not planned for European use. NORDINFO was interested in testing this new technique in Nordic university libraries and decided to fund an Ariel project, led by the VTT Information Service. At that time Ariel was used by about 30 libraries in the US. In September 1992, the VTT Information Service contacted twenty university libraries in the Nordic countries. In the first place, libraries with large volumes of interlending loans were chosen, but also other aspects such as geographic locations, and libraries with already established contacts, were considered. Seventeen libraries finally participated in the project. The libraries and their interlending activities are listed in table 1.

According to the latest available Nordic interlibrary loan statistics[2] of national, university and special libraries, the total amount of loans effected by copying was about 750 000 in 1991. The corresponding figures from Ariel libraries were, in 1992, totally about 470 000 document copies, thus representing more than 60 % of this category of libraries.

The Ariel software supplied to the participating libraries was funded by NORDINFO, but the libraries were responsible for the hardware and for the personnel involved in the project. The installations of the software started in October 1992 and were finished in February 1993, depending on when the libraries got the equipment. None of the libraries had the needed hardware available before hand. When technical or other problems occurred the project team contacted the RLG help desk by electronic mail or dis-

cussed the topic with the other libraries. Information obtained from the ARIE-L electronic mail discussion group, in which Ariel users as well as RLG participate, was also useful. Transmission of documents started immediately the first installations were made. Several hundreds of documents were transmitted during a test period of two weeks at the beginning of 1993. Details of the project are found in the project report[3].

Library	Loans effected by copying	Documents received as copies
The Karolinska Institute, Library and Information Center, Sweden	115 000	6 400
The Danish National Library of Science and Medicine, Denmark	100 000	2 500
State and University Library, Denmark	49 000	17 600
Technical University Library of Norway	36 000	14 400
The Royal Institute of Technology Library, Sweden	33 000	4 000
The National Technological Library of Denmark	23 000	2 400
Chalmers University of Technology Library, Sweden	18 600	3 200
National Library of Health Sciences, Finland	18 500	3 700
Lund University Library UB2, Sweden	16 200	11 000
Helsinki University of Technology Library, Finland	15 400	4 800
The University of Oslo Library, Faculty of Mathematics and Natural Science Library, Norway	13 700	5 200
University Library of Umeå, Sweden	8 000	6 000
The VTT Information Service, Finland	2 000	8 000
Helsinki University Library, Science Library, Finland	5 500	600
Helsinki University Library of Agriculture, Finland	5 000	800
Helsinki School of Economics Library, Finland	3 000	200
University Library, Iceland	2 300	4 000
Linköping University Library, Technological Library, Sweden	2 300	3 100

Table 1. The participating libraries

5. Results of the project

The project was successful on the whole. Ariel was installed and working in seventeen university libraries in five Nordic countries. The use of Ariel still continues in many of the libraries. More than one thousand articles of good quality were transmitted during the project period as part of normal interlending activities. Some of the libraries sent hundreds of documents, while other libraries got only few Ariel requests, but received far more than they sent. For instance, the Royal Institute of Technology Library, sent during a three month period ,nearly 300 articles to 9 libraries, the Helsinki University of Technology Library transmitted to the VTT Information Service more than 100 articles in two months. During the two test weeks, the Library and Information Center of the Karolinska Institute distributed a total of 130, sendings about 300 articles to 12 libraries.

Each participating library was eager and interested to use the new technology and test new possibilities for document delivery. The installations of Ariel succeeded well in spite of some small difficulties. The transmission of scanned documents over the Internet worked well and resulted in mostly high quality documents. The opinions of the libraries using Ariel were analysed by sending out questionnaires and by interviewing the staff.

6. Problems encountered in the project

Some of the problems concerning the Nordic and European use of Ariel were known from the beginning of the project. One of them is the lack of options for scanning of, and printing on, standard A4 paper size: to manage the printing of Ariel files consisting of many pages, the user had to press a button before each page. Another inconvenience is that Scandinavian characters can not be used on the header page. In any case, there were occasional means to handle these problems. During the project innovative participants created various methods to solve the A4 problem. To print continuously on A4 paper the participants either used manual feed of paper, acquired a tray for legal paper or modified the existing tray, or set the printer to omit error messages. OIIn the header page, the Scandinavian characters had to be transcribed, Linköping as Linkoeping, Umeå as Umea. These temporary solutions work satisfactorily while waiting for European standards options.

Two libraries could not, at the time, use Ariel because they did not have in their lending departments direct access to the Internet. These two participants, the technological libraries in Trondheim and Helsinki found, however, a way out by installing Ariel in fac-

ulty libraries situated near by. This decision enabled the libraries to participate, but caused additional work for the library personnel.

The Ariel transmissions started well in Iceland, Finland, Norway and Sweden. There were momentary problems with half-pages printing, which disappeared by updating the Ariel software. The Danish libraries, however, met with difficulties when they tried to send documents outside Denmark. After some testing, it became clear that the Danish network DENet, for security reasons, had restrictions for TFTP transmission across the borders. An opening of the network for Ariel files would have caused additional expense and was not, for the time being, possible. At that time, RLG had already decided to use the FTP protocol instead of the TFTP in the next version of Ariel, but the time schedule had not been decided. As a result, the Danish libraries unfortunately could not participate to any great extent.

7. Opinions of the participating libraries

In any case, the libraries were keen to test the new technology and new means for document delivery. Many of them made additional tests, to compare Ariel with traditional interlending routines. Ariel was successfully installed in the libraries despite some minor problems. The use of Ariel seemed to be quite easy. The following table gives a summary of the libraries' views about the installation and use of Ariel.

Installation of Ariel	
- easy	3 libraries
- average	8 libraries
- difficult	3 libraries
The use of Ariel	
- easy	11 libraries
- average	3 libraries

Table 2. The installation and use of Ariel

However, the participants were not altogether satisfied with the scanning process. A general view was that the whole operation was too slow in comparison to conventional methods. To scan a page from a thick book, e.g., bound volumes of journals, was not easy without seeing the result. To choose the best scanning options for photographs

needed training too. The scanners currently supported by Ariel are not developed for rapid, high volume scanning. Scanning of one page took, depending on the PC, 10 to 14 seconds and the retraction of the scanning head somewhat less. The scanning could be speeded up by using a sheet feeder, but that meant that the document had to be copied first. Opinions about the Ariel process are compiled in Table 3.

Scanning versus copying		**Printing speed**	
- the same	9 libraries	- satisfactory	7 libraries
- more troublesome	5 libraries	- not high enough	4 libraries
- much more troublesome	1 library	**Quality of document**	
Scanning speed versus copying		- very good	3 libraries
- slower	9 libraries	- good	9 libraries
- more than double as slow	5 libraries	- poor	1 library
Transmission speed		**Quality versus fax 3**	
- high	10 libraries	- better	12 libraries
- normal	1 library	- the same	1 library
- slow	3 libraries	- not as good	1 library

Table 3. Opinions concerning the use and quality of Ariel[1]

The transmission speed was, on the other hand, considered high enough and the printing speed satisfied most of the participants as well. The quality of the received documents was, in most cases, considered good or very good and, with some exceptions, better than documents received by fax 3.

8. Strong and weak points

One important goal of the project was to collect suggestions for improvements and opinions of strong and weak points, and then forward a "wish" list to the Research Libraries Group for further consideration. Compiled lists of strong and weak points follow below:

Strong points in Ariel

* Rapid transmission, free, good quality, no mailing
* Simultaneous scan, send, receive and print

[1]The total numbers of answers differ slightly

* Retransmission in the send queue
* Rapid document delivery improving our customer service
* Enormous potential for this kind of information media, but the use is limited by the scanner

Weak points in Ariel

* Slow scanning
* Casual scanning problems: skew scanning, bad margins, ball pen writing shows faintly, photographs need other settings
* No A4 options
* Scanned documents cannot be viewed
* Other programs cannot been used at the same time (Windows)
* Only American characters on the header page

A faster scanning procedure is at the top of the wish list sent to RLG. This improvement is demanded by almost all the participants, and is, for many libraries, an absolute condition for wider use of Ariel in the future. Means to view scanned pages on screen are considered almost as important, followed by options for A4 paper and a Windows version.

9. Other aspects in using Ariel

Some of the libraries made comparisons between the time needed for sending documents by Ariel and by fax or mail. The results were rather contrary and further tests are needed. One library calculated that sending documents by Ariel takes about three times as long as copying the documents and sending them by mail. Another library estimated that the time needed for sending by Ariel, and for taking copies and mailing them, is the same. The first one had developed highly standardised routines for large interlending volumes, while the second received only some few requests a day. The time needed for Ariel sendings also depends on the power, speed and memory of the equipment. The scanning process is evidently slower than copying, but on the other hand Ariel needs no envelopes nor stamps.

The pricing of document delivery methods depends on the amount of work and on the costs for the equipment and transmission. Within the project no pricing recommendations were made. Most of the libraries charged for Ariel sendings the same as for copying

and sending by mail. After the test period some libraries started to charge for Ariel documents as for rush delivery by fax. The higher price resulted in fewer requests for Ariel. When comparing Ariel with mail and fax, the rapid and free transmission over the Internet must also be taken into account..

Integrating new methods in interlibrary lending routines is not always a simple task. The need of using the apparatus, e.g., the scanner used also for other tasks sets some limitations for the location. Libraries with a hundred or more requests for article copies arrange their routines in a different way from libraries with some few requests. The integration of Ariel into normal interlending routines will thus be done in different ways.

Storing electronic documents may cause copyright problems. Ariel has a "send and delete" and a "send and retrieve" option. The "send and retrieve" option makes it possible to send the same electronic document to other customers. The receiving files are automatically deleted after printing. However, the copyright matter was not especially studied in this project, but it evidently needs further investigations.

10. Future aspects

The NORDINFO project was in many aspects a success. Ariel was successfully installed and worked in seventeen Nordic university libraries. More than one thousand documents were transmitted during the entire project. A survey of technical and other problems, faults, strong points and user opinions was made. The rather slow scanning process seems to be the biggest obstacle for a wider use of Ariel in the Nordic countries. However, about half of the libraries intend to continue using Ariel in its present form, the other half has not decided yet. The Research Libraries Group´s reaction to the suggested improvements will naturally influence the future use. Another important aspect is the number of Ariel users, especially libraries in the same field: the use of Ariel has steadily grown, about 350 software packages have been sold world-wide[4].

Electronic document supply is today a hot topic. Publishers, as well as subscribing agencies, database host organisations, libraries and software producers are all potential providers of electronic documents. Some twenty or thirty projects in the field of electronic document storage and delivery are going on round the world[4]. Ariel is the first PC product for scanning and sending documents over the Internet. The North Carolina State University's DDTP (Digitized Document Transmission Project) is a somewhat similar product, developed for a Macintosh computer, but it is not yet commercially

available. With another PC product, XpressNet, the user can receive over the Internet scanned articles sent by the supplier Article Express International, but the software has no scanning or sending options. On the other hand, Article Index International as well as The Institute of Electrical and Electronics Engineers have recently announced that they will supply documents also by Ariel.

A new era of electronic document delivery systems has started. Thanks to NORDINFO, libraries in the Nordic countries have had the opportunity to test and use the new technology. It is to be hoped that the results of this Nordic project will influence the development of Ariel as well as of other methods for electronic document delivery.

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Abbreviations:

NORDINFO = The Nordic Council for Scientific Information
NOSP = The Nordic union catalogue of serials
IANI = Intelligent Access to Nordic Information Services
TCP/IP = Transmission Control Protocol/Internet Protocol
HP = Hewlett Packard
TFTP = Trivial File Transmission Protocol
UDP = User Datagram Protocol
FTP = File Transmission Protocol
RLG = Research Libraries Group